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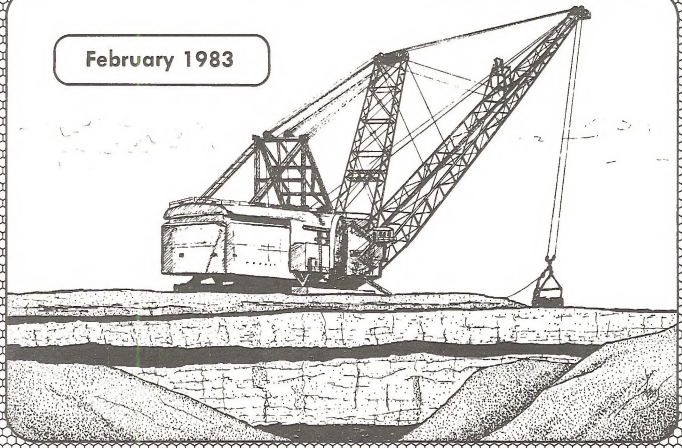
NORTHERN POWDER RIVER TRACT PROFILE

HANGING WOMAN CREEK

February 1983



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POWDER RIVER RESOURCE AREA TRACT PROFILE
HANGING WOMAN CREEK

PART I: SITE-SPECIFIC ANALYSIS OF THE HANGING WOMAN CREEK COAL LEASE TRACT

By Bureau of Land Management

PART II: TRACT SUMMARY REPORT, HANGING WOMAN CREEK

By Resource Evaluation

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CONTENTS

PART I

DESCRIPTION OF THE PROPOSED ACTION 1
CHAPTER I — AFFECTED ENVIRONMENT 3
- Geology and Topography 3
- Soils 3
- Water Resources 3
- Vegetation 4
- Agriculture 5
- Ownership and Land Use 5
- Wildlife 8
- Cultural Resources 8
- Recreation 8
- Visual Resources Management 8
- Climate and Air Quality 9
- Noise 9
- Transportation Facilities 9
- Socioeconomics 9

CHAPTER II — ENVIRONMENTAL CONSEQUENCES 11
- Geology and Topography 11
- Soils 11
- Water Resources 11
- Vegetation 13
- Agriculture 13
- Ownership and Land Use 13
- Wildlife 14
- Cultural Resources 14
- Recreation 14
- Visual Resources Management 14
- Climate and Air Quality 14
- Noise 15
- Transportation Facilities 15
- Socioeconomics 15
- Net Energy Analysis 20

REFERENCES 21
APPENDICES 25

PART II

Tract Description 37
Entities Expressing Interest 38
Coal Resource Class Designation 38
Coal Geology 40
Potential Use of Coal 41
Transportation 41
Mineability 41
Marketability 42
Attachments 43

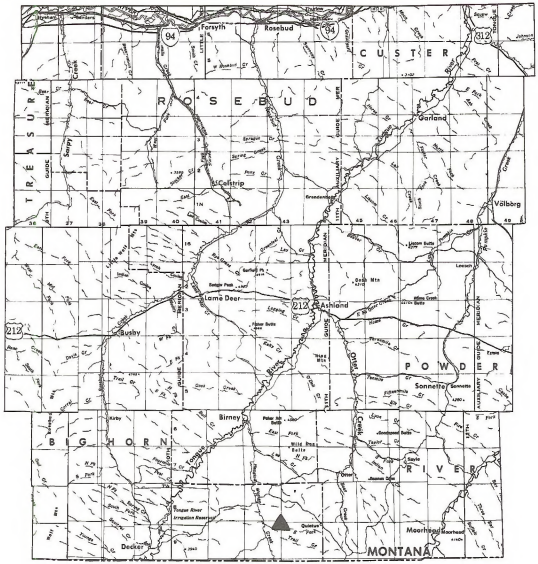
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

PART I

Site-Specific Analysis
Hanging Woman Creek Coal Lease Tract
Big Horn County, Montana

Miles City District Office
Miles City, Montana

February 1983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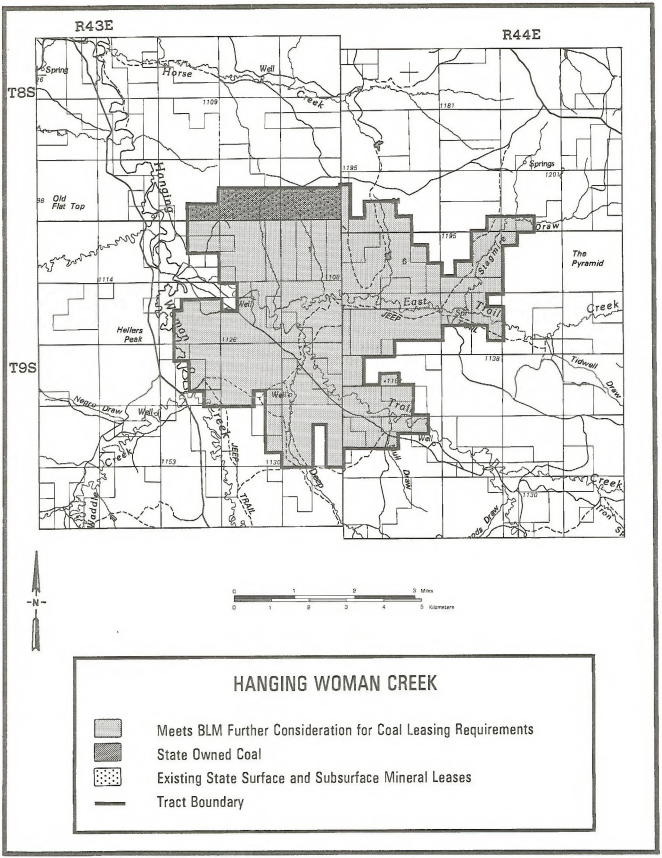
LOCATION MAP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DESCRIPTION OF THE PROPOSED ACTION

The proposed action is to offer for competitive lease a 9,864 acre tract of land in southeastern Big Horn County, Montana. The tract contains 400 million tons of recoverable coal, of which 27.2 million tons are known to be leased. This comprises an area identified by Resources Evaluation as an economical mining unit for the development of a 40-year strip mining operation. It is located approximately 19 miles east of Decker and 17 miles south of Birney. The maps preceding this page show the general location of the tract. Attachment A to Part II gives a legal description of the tract.

In preparing to offer this tract, personnel from the BLM, Miles City District, inventoried to determine the site specific resource values and then analyzed the potential environmental effects from coal development on this individual tract. Total surface disturbance was assumed to present a worst case scenario. Previous planning included application of surface owner consultation, multiple use and unsuitability criteria (43 CFR 3461). Any new findings of unsuitability are reflected in the delineation and development proposal of the tract described in this profile.

The tract contains, in place, 598.8 million tons of federal coal and 51.2 million tons of state coal. The 720 acres of state coal are leased and will not be considered as part of the affected environment in this profile. Annual production from the mining unit is assumed to be 10 million tons. Using an assumed typical 10 million ton per year production rate, approximately 450 persons would be employed at the peak of construction with 300 employed during production.

Surface disturbance due to mining would be about 249 acres each year. A total of 9,864 acres would be disturbed. If mine facilities are located outside the tract, some additional surface acreage would be disturbed. Development of railroad access would disturb approximately 364 acres. More specific information on the proposed mining operation is available in Part II, "Tract Summary Report," prepared by Resources Evaluation.

It is assumed that proper mining and reclamation would be carried out according to existing state and federal regulations. These regulations include: Office of Surface Mining Reclamation and Enforcement (30 CFR 700-899); Environmental Protection Agency (40 CFR 0-399); Department of the Interior's coal management program regulations (30 CFR 211, 43 CFR 23, and 43 CFR 3400); and the regulations of the Montana Department of State Lands.

CHAPTER I
THE AFFECTED ENVIRONMENT

GEOLOGY AND TOPOGRAPHY

Geology

Two coal seams appear at the surface. At the higher elevations, the Anderson seam is exposed at 50 to 70 feet above the Dietz 1. Extensive Dietz 1 exposures are present throughout the area.

The two coal beds of economic importance are the Anderson and Dietz 1. The Anderson averages 31 feet in thickness. The overburden ranges from 0 to 420 feet in thickness. The coal rank is subbituminous and average British Thermal Unit (BTU) content is 8,500 per pound. Estimated tract tonnage is about 72.8 million tons. The Dietz 1 seam averages about 13 feet in thickness. Maximum overburden ranges from 100 to 200 feet. The interburden between the two seams ranges from 40 to 140 feet in thickness.

The BTU content of the Dietz bed averages about 8,300 per pound.

The surface rocks are within the upper Paleocene Tongue River Member of the Fort Union Formation. This area has been partially dissected by coulees draining into Trail Creek or the East Fork of Trail Creek.

One large southwest trending fault is present. Maximum displacement is about 230 feet. Otherwise, structural geology is uncomplicated. Regional dip is about 1° southwest.

Paleontological remnants consist primarily of fossil leaves and freshwater fossil shells. However, nothing of paleontological significance has been found in the general area.

No locatable mineral deposits are known to exist in the area. Other than coal, the only mineral of value known to be present is scoria.

Topography

The Trail Creek portion of the Hanging Woman tract ranges in elevation from about 3,500 feet to 3,950 feet.

Lower areas of the tract along Hanging Woman, Trail and East Fork of Trail Creek consist of preliminarily identified alluvial valley floors. Trail Creek and the East Fork of Trail Creek drain into Hanging Woman Creek.

Resistant sandstones are present at about 3,820 feet elevation and about 3,920 feet. These beds tend to form resistant, flat-lying erosion surfaces with little relief. Several of the higher hill masses have flat tops, formed from the lower of these resistant sandstones. Where both of the resistant sandsones are present, a more or less gradual erosional slope separates the two sandstones.

SOILS

Soils are composed of deep loamy (Fort Collins, Haverson, McRae) or clayey (Heidt, Hydro), calcareous alluvial soils, on nearly level to gently sloping (2-8% slope) fans, footslopes and terraces. Moderately deep, loamy calcareous soils (Thedalund) over softly consolidated siltstones and sandstones exist on strongly sloping (8-25%) sideslopes. Shallow, thin surface, clayey (Midway) calcareous soils exist over softly consolidated clay shale on hilly to steep (15-45% slopes) sideslopes, ridges and knolls.

Many mapping units throughout the coal area occur as complex, variable patterns of deep, moderately deep, and shallow soils, some of which include rock outcrops.

The soils data is from the Big Horn County Order II published survey.

WATER RESOURCES

Groundwater

This tract is underlain by several aquifers. Shallow aquifers are alluvium, Anderson clinker, and Tongue River Member of the Fort Union Formation. The 240-foot thick Lebo Shale Member of the Fort Union separates the Tongue River Member from deeper aquifers, which include the Tullock Member (Ft. Union Formation), Hell Creek and Fox Hills aquifers, various sandstones and shales, and the Madison Group.

Alluvium under East Trail Creek has an average thickness of about 34 feet. Water table levels in the alluvium range from seven feet below land surface near the stream channels to 24 feet on nearby slopes.

Tongue River Member contains lenticular siltstone and sandstone that is not really extensive. These grade abruptly into Anderson clinker at the tract's western boundary. Anderson, Dietz, and Canyon coal beds are apparently the most continuous shallow aquifers. Some water in the Anderson discharges west, through the clinker, into alluvium along Trail Creek.

The East Trail Creek fault is present in the southeastern part of the tract. This fault retards groundwater flow. Springs located in Section 8, T9S, R44E, may be fault-related.

Water depths of wells in Anderson coal are a reflection of topography. Well-water depths in high topographic areas are about 137 feet, but along East Trail and Trail Creeks, they are within six feet of ground surface. The Dietz coal bed aquifer reflects similar behavior to the Anderson except that water levels are 20 to 80 feet lower.

An area having progressively deeper water levels with progressively deeper aquifers is generally interpreted to be a recharge area.

Wells penetrating coal seams generally discharge at a rate of 10 gallons per minute (gpm) and less. Alluvial wells discharge at a rate of almost 18 gpm and less.

Transmissivity and hydraulic conductivity values for coal are, respectively about 20 square feet per day (ft^2/day) and three feet per day (ft/d). For alluvium, transmissivity and conductivity, respectively, are about 1,450 ft^2/d and 88 ft/d. Average velocity of water passing through alluvium is about 3.3 ft/d; through coals it is estimated to be about 0.4 ft/d.

Groundwater quality is quite variable. Total dissolved solids (TDS) range from 438 to 9,460 milligrams per liter (mg/1). Concentrations for alluvium range from 3,760 to 5,910 mg/1.

Four stock or domestic wells exist within the tract and 27 cased test wells are also present.

Surface Water

Hanging Woman Creek, a perennial stream, intersects only a very small portion of the southwestern part of this tract. The tract is drained mainly by Trail Creek, East Trail Creek, and Deep Creek, ephemeral streams, and by their ephemeral tributaries, all of which eventually dump into Hanging Woman Creek. Mean discharge for East Trail Creek is 0.23 cubic feet per second, (cfs), for water years 1977-1980. The maximum recorded flow during that same period is 215 cfs (May 18, 1978).

Average discharge for Hanging Woman (USGS stations just south of Birney) is 5.84 cfs (1973-1980) and the maximum is 2,050 cfs (May 19, 1978). The mean annual flood of East Trail Creek was estimated to be 100 cfs. The 25-year and 100-year floods are about 700 and 1,250 cfs, respectively.

Five stock ponds are indicated to exist in the tract by topographic maps. Three of these are shown to be perennial. Undoubtedly more have been constructed since these maps were printed. The largest reservoir recorded is about three acres in surface area and is on public land. One spring on state owned surface is also present.

The USGS has conducted limited water quality monitoring for East Trail Creek. Average total dissolved solids (TDS) concentration for the values provided is 3,500 milligrams per liter (mg/1). Average discharge, for values corresponding to the dates TDS was measured, is 6.38 cfs. Hanging Woman Creek just below Birney had an average TDS concentration of 2,031 mg/1, corresponding to an average discharge of 10.8 cfs (water years (1976-80).

Alluvial Valley Floors and Floodplains

There are preliminarily identified alluvial valley floors along Hanging Woman Creek, Trail Creek, and East Trail Creek. An office of Surface Mining (OSM) and Department of State lands determination of the existence and extent of these potential AVFs will have to be made prior to mine permit approval (BLM 1981).

A very small area in the southwestern portion of this tract includes part of the 100-year flood plain of Hanging Woman Creek. It has not been determined whether there is a substantial threat of loss of life or property.

VEGETATION

The Hanging Woman coal tract consists of approximately 9,144 surface acres. Of that, 8,486 surface acres (92.8%) of the area is rangeland. The balance is 658 acres (7.2%) of cropland. The rangeland consists of four dominant range sites. These range sites, in acres and percentage of the coal tract, are silty 1,907 (22%), clayey 1,945 (23%), shallow clay-silty 1,840 (22%), shallow-silty 1,252 (15%). Other range site complexes total 1,542 acres (18%) of the coal tract.

Within these range sites, there are varying production yields (pounds per acre) and condition classifications. The silty site produced 321 AUMs (21%), clayey 486 AUMs (32%), shallow clay-silty 331 AUMs (22%), shallow-silty 157 AUMs (10%), and other range site complexes 239 AUMs (15%) of the coal tract. There are approximately 1,534 AUMs being produced per year on the coal tract in its present condition.

AGRICULTURE

Of the 9,144 surface acres, only 32.01% (2,927 acres) of the tract is suitable for cropland (Class II, III and IV land). Of that amount only 7.20% (658 acres) is currently being used as cropland. The balance is Class VI through VIII, which is suitable for rangeland, watershed and wildlife.

Agricultural operations are mainly livestock with small areas of hay (alfalfa or grass legume), small grains and tame pasture (Table HW-1). Hay or small grains are mainly grown for livestock feed during the winter months. Some small grains are grown for sale.

This area currently has 17 acres of Class III and IV land (0.19%) in hay, which produces approximately 15 tons per year under dryland conditions. About 17 acres could be or are irrigated which would produce approximately an additional 62 tons of hay per year.

Approximately 641 acres of Class II and III land (7.01% are in tame pasture, which will provide approximately 573 AUMs per year under dryland conditions. About 635 acres could be or are irrigated and would provide an additional 5,903 AUMs.

In addition, there are approximately 2,269 acres of Class II, III and IV land (24.8%) which are not presently cropped, but are suitable for cropland. This land could produce approximately 1,799 tons of hay or 12,600 bushels of wheat under dryland farming operations. Wheat production is based on the assumption that 50% of the cropland is summer fallowed. Of that acreage, there are 682 acres which could be irrigated and yield an additional 2,546 tons of alfalfa hay or 26,686 bushels of wheat. This land is currently utilized as rangeland.

OWNERSHIP AND LAND USE

Table HW-2 displays the ownership of surface and coal in the Hanging Woman tract. Within this tract, 590 acres are held by energy-related landowners. Table HW-3 displays surface ownership in the tract by landowners not related to energy and the relationship between their holdings in the tract to their holdings within a boundary approximately two miles outside the perimeter of the tract. (Note that this table does not portray the relationship of the landowner's tract ownership to their total land ownership.)

TABLE HW-2

OWNERSHIP OF SURFACE AND COAL IN THE HANGING WOMAN TRACT

	Acreage of Surface Owned	Acreage of Coal Owned
Private Landowner	7,682	—
State of Montana	1,342	720 (leased)
United States	840	9,144

TABLE HW-3

SURFACE OWNERSHIP BY PRIVATE LANDOWNERS WITHIN THE HANGING WOMAN COAL TRACT AND THE RELATIONSHIP TO THEIR HOLDINGS WITHIN A TWO-MILE BOUNDARY

Owner Number	Acreage Owned in This Tract	Acreage Owned Over Federal Coal in This Tract	Percentage of Owner's Tract Holdings to His Holdings Within a Two-Mile Boundary
1	6,891	6,891	25
2	201	201	100

TABLE HW-1

AGRICULTURAL LAND USE TABLE

PRESENT USE OF LAND	ACRES	PCT OF AREA	LAND CLASS 2/ CAPABILITY NON-IRRIGATED	LAND CLASS 2/ CAPABILITY IRRIGATED	PREDICTED AVERAGE YIELDS WHEAT DRY LAND (BU)	WHEAT IRRIGATED (BU)	BARLEY DRY LAND (BU)	BARLEY IRRIGATED (BU)	OATS DRY LAND (BU)	OATS IRRIGATED (BU)	ALFALFA DRY LAND (TON)	ALFALFA IRRIGATED (TONS)	TAME HAY DRY LAND (TONS)	PASTURE DRY LAND (AUMS)	PASTURE IRRIGATED (AUMS)
Privately Owned															
Cropped (Hay)	17	0.19	IV	III	408	867	629	986	-	1,445	15	77	14	14	170
Total	17	0.19	-	-	408	867	629	986	-	1,445	15	77	14	14	170
Cropped (Tame Pasture)	205	2.24	III	II	4,914	11,505	7,724	13,952	8,800	18,158	192	1,096	170	185	2,212
Cropped (Tame Pasture)	407	4.45	III	III	8,506	19,545	13,599	26,362	4,150	32,639	375	1,832	313	362	4,029
Cropped (Tame Pasture)	6	0.07	III	-	120	-	198	-	-	-	5	-	4	5	-
Total	618	6.76	-	-	13,540	31,050	21,521	40,314	12,950	50,797	572	2,928	487	552	6,241
State Owned															
Cropped (Tame Pasture)	23	0.25	III	III	483	1,081	759	1,518	-	1,840	21	104	18	21	230
Total	23	0.25	-	-	483	1,081	759	1,518	-	1,840	21	104	18	21	230
Total Cropped Land	658	7.20	-	-	14,431	32,998	22,909	42,818	12,950	54,082	608	3,109	519	587	6,641
Privately Owned															
Noncropped (Range)	119	1.30	III	II	3,054	6,618	4,849	8,269	4,454	10,504	114	619	102	107	1,358
Noncropped (Range)	455	4.98	III	III	9,498	21,961	15,247	29,338	5,750	36,511	421	2,048	347	404	4,493
Noncropped (Range)	255	2.79	III	-	6,680	-	9,969	-	-	-	213	-	38	242	-
Noncropped (Range)	915	10.01	IV	-	608	-	951	-	-	-	675	-	492	615	-
Total	1,744	19.08	-	-	19,840	28,579	31,016	37,607	10,204	47,015	1,423	2,667	979	1,368	5,851

TABLE HW-1

AGRICULTURAL LAND USE TABLE

PRESENT USE OF LAND	ACRES	PCT OF AREA	LAND CLASS CAPABILITY		PREDICTED AVERAGE YIELDS									
					WHEAT		BARLEY		OATS		ALFALFA		TAME HAY	PASTURE	
			NON-IRRI-GATED	IRRI-GATED	DRY LAND (BU)	IRRI-GATED (BU)	DRY LAND (BU)	IRRI-GATED (BU)	DRY LAND (BU)	IRRI-GATED (BU)	DRY LAND (TON)	IRRI-GATED (TONS)	DRY LAND (TONS)	DRY LAND (AUMS)	IRRI-GATED (AUMS)
State Owned															
Noncropped (Range)	8	0.09	III	II	196	436	312	556	412	692	8	40	7	7	92
Noncropped (Range)	53	0.58	III	III	1,089	2,587	1,749	3,402	1,200	4,360	48	239	40	48	506
Noncropped (Range)	45	0.49	III	-	1,047	-	1,611	-	-	-	41	-	-	38	-
Noncropped (Range)	68	0.74	IV	-	280	-	420	-	-	-	35	-	21	52	-
Total	174	1.90	-	-	2,612	3,023	4,092	3,958	1,612	5,052	132	279	68	145	598
Federal Land															
Noncropped (Range)	34	0.37	III	II	820	1,938	1,276	2,446	1,724	3,180	31	175	30	31	364
Noncropped (Range)	13	0.14	III	III	273	611	429	858	-	1,040	12	59	10	12	130
Noncropped (Range)	23	0.25	III	-	621	-	920	-	-	-	21	-	-	21	-
Noncropped (Range)	281	3.07	IV	-	434	-	651	-	-	-	180	-	134	202	-
Total	351	3.83	-	-	2,148	2,549	3,276	3,304	1,724	4,220	244	234	174	266	494
Total Noncropped (Range)	2,269	24.81	-	-	24,600	34,151	38,384	44,869	13,540	56,287	1,799	3,180	1,221	1,779	6,943

1/ Cropland, land suitable for cropland and average predicted crop yields derived from published Big Horn County Soil Survey, December 1977, Soil Conservation Service and Bureau of Indian Affairs and data from Agricultural Stabilization and Conservation Service, Big Horn County.

2/ Land class capability is derived from published Big Horn County Soil Survey, December 1977, Soil Conservation Service and Bureau of Indian Affairs.

In 1980 and 1981 the BLM conducted a survey of the private landowners in the Hanging Woman tract. It was ascertained that all of the landowners had given written consent to the mining of federal coal underneath their property.

WILDLIFE

Two sage grouse leks occur within this tract; two others are within a mile of the western edge of the tract. To aid in mitigating anticipated impacts of future coal development, the Montana Department of Fish, Wildlife & Parks entered into an agreement with the Kendrick Cattle Company to manage certain lands for the continued existence of a healthy sage grouse population (BLM 1981); these leks are covered in that agreement.

State land in the northwest portion of the tract provides prime winter habitat for mule deer and antelope; these overlapping ranges do extend over federal coal (BLM 1981).

There is no known occurrence of any threatened or endangered species on the tract. However, all or portions of a number of prairie dog towns occur within the tract. They were surveyed for black-footed ferret in 1980; no ferret sign was found in the area of the tract (BLM 1981). Since these surveys are good for only one year, a ferret survey will have to be done before mine plan approval.

Golden eagles, prairie falcons, ferruginous hawks, and burrowing owls nest in the vicinity of the tract. No known nests occur on the tract and there is adequate hunting territory outside the tract for these raptors.

An analysis of the aquatic resources in the Hanging Woman Creek drainage (Morris 1982) showed that although there is no significant sport fishery in the area, care must be taken to protect the quality of the downstream waters which provide spawning habitat for various sport fish.

CULTURAL RESOURCES

A total of 2,140 acres, or 22.85% of the surface over federally owned mineral estate has been inventoried to Class III levels. Eight prehistoric and historic sites have been recorded in the inventoried area. Two sites are on state land overlying federal mineral, while the other six are on private surface over federal mineral. Unsuitability Criterion 7 has been applied to all eight sites in the 1081 Powder River Amendment. Seven sites, 24 BH 306, 2027, 2028, 2029, 2030, 2031 and 2032, lack sufficient information for a determination of eligibility to the National Register of Historic Places, while site 24 BH 2028 does not appear to meet the standards for eligibility to the register. No sites are known on state mineral estate lands.

RECREATION

This tract does not have legal access, although a trail does follow Trail Creek. Any recreation on this tract would first necessitate landowner permission. Hunting, if permitted, is probably the only form of public recreation occurring on this tract. The tract does not have public recreation facilities nor does it have natural or wilderness values.

VISUAL RESOURCES MANAGEMENT

Trail Creek, which runs diagonally through the tract, has sparse stands of deciduous trees growing in the riparian zone. The majority of the tract is a grass-sagebrush biome intermingled with greasewood. The surrounding ridgetops have scattered stands of pine trees; however, more heavily forested areas are located in the northern section of the tract.

The ridgetops located in the tract have outcrops of scoria and sandstone. The terrain from the creek bottoms to the base of the ridges tends to be somewhat broken with outcrops of sandstone and shale.

CLIMATE AND AIR QUALITY

Some climatic information is available from the Otter 9SSW weather station. This area is influenced primarily by a continental climate and convective thunderstorms in the summer. Annual average precipitation in this area ranges from 13 to 15 inches. Forty-six percent of the precipitation occurs in April, May, and June. Greatest snow accumulations occur in January and February. Average snow depth in January is almost nine inches and in February slightly more than seven inches. Minimum monthly average temperature at Otter 9SSW is 20°F; maximum monthly average is 71°F. Average number of days between the last spring occurrence of 32°F and the first fall 32°F temperature is about 128 days at Broadus. Estimated potential evapotranspiration is 26 inches. Winds are predominantly from the west to north-northwest (35%) and southeast to south (27%). Annual average wind speed is 10.2 mph.

Few geographic obstructions to dispersion of pollutants exist in this area. Dispersion is, however, frequently hindered by such meteorological conditions as low mixing heights, low wind speeds, and no precipitation.

This tract's air quality is generally very good. Background level for suspended particulate was determined by PEDCo Environmental to be 20 micrograms per cubic meter (mcg/m^3), but annual geometric means range from 9 mcg/m^3 to 56 mcg/m^3. Gaseous pollutants are currently so low they are not even monitored.

One Class I area, the Northern Cheyenne Indian Reservation, exists about 24 miles north of this tract. Visibility in the area ranges from 45 to 70 miles with a median summer visual range of about 60 miles.

NOISE

Data on existing ambient noise levels for a specific area is typically nonexistent, however this area is expected to have noise levels commonly experienced in rural and rangeland areas. Typical day-night sound levels for rural areas are estimated to be from 35 to 50 decibels (DEIS for East Decker Coal Mine). A normal conversation is equivalent to 50 to 60 decibels. (Powder River DEIS Coal).

TRANSPORTATION FACILITIES

U.S. Route 212 lies approximately 45 miles north of the Hanging Woman tract; Montana Highway 314 lie approximately 25 miles to the west. Two gravelled county roads lies in close proximity to the tract. One of the roads runs north to south and is about one-half mile from the west boundary of the tract. The other road runs northwest to southeast and is two to four miles from the north border of the tract. Approximately 3.3 miles of an improved ranch access road lies within the tract.

The closest railroad is the Burlington Northern line at Leiter, Wyoming, 30 miles distant.

SOCIOECONOMICS

Employment and Income

The area of Big Horn County that includes the Hanging Woman Creek tract is predominantly an agricultural community that has, over the years, changed little. The social and economic bases of the county have thus remained untouched.

The country's market value of all agricultural products sold in 1978 was $33,722,000. The average value per farm/ranch was $67,988 which is approximately $20,000 more than the state average per farm.

Cattle ranching is the leading contributor to agricultural production followed by wheat farming. Cattle production produced approximately $23 million, while wheat and hay cropland production produced approximately $10 million.

Big Horn County experienced a population gain of 9.36% over the decade of the 1970's. (See Table HW-4.)

This population growth can be primarily attributed to increased employment in the mining sector of the economy. Between 1975 and 1980, this sector of employment increased by approximately 700 people.

This increase in employment has led to a large increase in per capita income. (See Table HW-5.)

TABLE HW-4
POPULATION OF BIG HORN COUNTY

		Percent Change
1960	10,007	0.00
1970	10,057	0.50
1980	11,096	9.36

TABLE HW-5
BIG HORN COUNTY AND STATEWIDE PER CAPITA INCOME

	1975	1976	1977	1978	1979	1980
Mining Employment	262	340	473	794	928	963
Per Capita Income	$4,148	$4,195	$4,729	$6,427	$7,195	$8,082
Montana Per Capita	$5,419	$5,763	$6,172	$7,138	$7,787	$8,652

The contribution from mining has helped to increase the per capita income of the county over the years. It is still lower than the state average, but this has the potential to increase as more mining is developed.

Big Horn County's employment picture shows a decline of agricultural employment for the years 1975 through 1980. Major increases can be found in the mining and construction sectors. In 1975, direct farm employment in the county accounted for 11.9% of total employment. By 1980 that percentage had dropped to 7.4% of the total. Mining employment increased from 6.2% in 1975 to 17% of the total in 1980. Construction employment increased from 3.4% in 1975 to 10.8% of the total in 1980. The county's total employment increased more than 25% over this time period.

Community Facilities

The Hanging Woman coal tract is located in the southeastern part of the county. This area is thinly populated and communities in this area have not shown a tendency to grow with coal development. The attractiveness of Sheridan, Wyoming, has caused most workers in the area to commute. Sheridan will receive the greatest impact from development of new mines in this portion of the county.

The Northern Cheyenne and the Crow Indian Reservation economics are based primarily on jobs provided by the tribal government and federal programs. There has been a slow shift from a subsistence to a cash economy, but most households still rely on hunting and gathering to supplement their incomes. Chronic unemployment is a serious problem.

Due to sparse population, most people, consumer goods and agricultural products move by roadways. The road network is not well developed but is generally adequate for the existing population.

A loose network of county and Bureau of Indian Affairs roads provides ranchers and rural residents access to the primary and secondary road systems. These are mostly gravel surfaced, with curves and grades conforming closely to the existing terrain (Montco Mine EIS draft).

Existent Attitudes

Several surveys over the past five years in the area have shown, on a fairly consistent basis, that most of those interviewed are in favor of mineral development. A BLM study, conducted in 1979-1980, showed the principal reasons for supporting development are national energy needs and economic growth of the region. The study also showed respondents were in favor of mining controls.

CHAPTER II
ENVIRONMENTAL CONSEQUENCES

GEOLOGY AND TOPOGRAPHY

The postmining topography would be more subdued and rounded. The lesser slopes may promote increased moisture soil infiltration and decreased runoff.

Oil and gas wells could not be drilled during the active life of the mine, but since no active wells are or have been present to date, no impact would be felt by the oil and gas industry.

Some fossils would be destroyed by mining. Some new paleontological strata could be exposed. No known valuable fossils are present. Loss of these fossils would be a very minor impact.

Saleable mineral scoria would be destroyed by mining. A very minor amount of scoria has been used, primarily on roads. Overall, the impact of the loss of scoria would be minor, as little use is being made in the area.

Coal resources that are not economically minable at this time would be lost to future recovery under present laws, which preclude mining of reclaimed land.

SOILS

Soil impacts from mining activities include: displacement of soil from wind and water erosion, change in soil structure and natural fertility, salt migration through the soil profile after reconstruction, and significant problems in revegetation and stabilization on steep slopes.

Disturbance of the soil would result in alterations of soil structure and porosity. This alteration would affect permeability, infiltration rates, plant rooting, soil-air and soil-water relationships and bulk density. The natural fertility would be affected by disruption of the nutrient cycle and a decrease in organic matter content within the soil.

The soil mapping units in the Hanging Woman coal tract were evaluated for suitability of soil material for plant growth using USDA/SCS guidelines for "Soil Reconstruction Material for Drastically Disturbed Areas" (NSN 403.6(a)). These results are expressed as acre feet of soil material having good, fair and poor suitability due to soil physical and chemical properties. This showed 2% percent (515 acre feet) of the area rated good, 43% (11,651 acre feet) rated fair and 55% (14,900.5 acre feet) rated poor as to suitability for plant growth (Table HW-6).

Wind erosion potential for the tract is rated as 73% low and 27% moderate. The water erosion potential is rated as 16% low, 26% moderate and 58% high.

Areas within the tract may have poorer or better reclamation potential because of their unique soil distribution patterns. Suitable overburden materials, if available, could be used to provide additional material to provide for more adequate reclamation. Current information demonstrates that this area has fair to poor potential for successful reclamation.

WATER RESOURCES

Groundwater

Removal of coal and overburden within this tract would eliminate the spring, the wells, and stock ponds that currently exist. The resulting pit would act as a well and intercept groundwater flow, which would be pumped back to surface ponds and eventually stream channels. A surface mine in this area that penetrated the Anderson seam alone, if approximated by a well one-half mile in radius, would initially intercept water at a rate of about 0.7 cfs. This flow would gradually diminish to less than 0.1 cfs. If the mine penetrated one or two other coal beds, more than twice as much water would probably be produced by the mine. Drawdown caused by this dewatering could affect at least three wells and three springs in an area adjacent to this tract.

Spoil material placed back in the pit would result in elevated TDS concentrations in water that recharges and passes through the spoils. This effect would begin to decrease after equilibrium is reached. The TDS concentration is generally considered to be localized in extent. Spoil water would not be preferred for human consumption and irrigation, but would probably be suitable for livestock. Unaffected deeper aquifers would continue to be available as replacement sources of groundwater.

TABLE HW-6
HANGING WOMAN SOIL RECLAMATION ASSESSMENT

Mapping Unit Symbol	Mapping Unit Name	Acres	Pct. of Area	Slope	Erosion Potential from Wind	Erosion Potential from Water	Suitability of Soil Material for Plant Growth (acrefeet) Good	Fair	Poor
Ayd	Arvada silty clay loam	351	4	-	Low	Low	-	-	1755
Aye	Arvada-Bone clay	193	2	-	Low	Low	-	-	965
CW	Colby-Midway complex	290	3	8-15%	Low	Mod.	90	1012	17
Cz	Cushman loam, undulating	18	<1	-	Low	Mod.	-	53	8
FK	Fort Collins loam	94	1	2-4%	Low	Mod.	31	439	-
Fm	Fort Collins loam	17	<1	4-8%	Low	Mod.	6	79	-
Hfa	Haverson loam	63	1	0-2%	Low	Low	-	315	-
Hfc	Haverson loam, saline	11	<1	-	Low	Low	-	-	33
HGb	Haverson and Lohmiller soils, frequently flooded	997	11	-	Low	High	-	-	4980
Hlc	Heldt silty clay loam	629	7	4-8%	Low	Low	-	3145	-
Hlg	Heldt-Hysham silty clay loams	34	<1	2-4%	Low	Mod.	-	128	42
Hna	Hydro loam	246	2	0-8%	Low	Mod.	103	-	1127
Hnh	Hydro-Allentine complex	39	1	4-8%	Low	Mod.	12	-	183
Ho	Hysham loam	93	1	0-2%	Low	Low	-	-	465
Kg	Kim loam	8	<1	4-15%	Mod.	High	-	40	-
Mr	McRae loam	73	1	1-4%	Low	Mod.	31	334	-
Ms	McRae loam	100	1	4-8%	Low	Mod.	42	458	-
Mu	Midway silty clay loam, undulating	61	1	-	Low	Mod.	-	-	71
MVa	Midway silty clay loam, rolling	464	5	-	Mod.	High	-	-	543
MVe	Midway-Thedalund complex, rolling	1252	14	-	Mod.	High	-	213	1402
MVf	Midway-Thedalund complex, hilly	1840	20	-	Low	High	-	313	1785
SOc	Shale outcrop-Midway complex, steep	66	1	-	Mod.	High	-	69	17
Tg	Thedalund loam, undulating	20	<1	-	Low	Mod.	13	33	-
THe	Thedalund-Midway complex	124	2	-	Low	Mod.	53	233	-
THg	Thedalund-Rock outcrop	591	7	-	Mod.	High	59	1022	236
THl	Thedalund-Wibaux loams	30	<1	-	Low	Mod.	9	23	31
THm	Thedalund-Wibaux complex	118	1	-	Low	Mod.	54	172	25
THn	Thedalund-Wibaux stony loams	2	<1	-	Low	High	-	2	0.5
Tm	Thurlow silty clay loam	136	1	-	Low	Low	-	680	-
Tn	Thurlow silty clay loam	222	2	-	Low	Mod.	-	648	100
To	Thurlow-Midway silty clay loams	742	8	-	Low	Mod.	-	2167	334
TS	Travessilla-Thedalund loams	66	1	-	Low	Mod.	18	73	11
Vc	Vananda clay	154	2	1-8%	Low	Mod.	-	-	770
		9,144	100				515	11,651	14,900.5
							2%	43%	55%

Surface Water

Surface water would be affected by surface mining primarily during the mining period, when existing drainage patterns in parts of the area would be displaced, runoff would be intercepted, and existing reservoirs would be removed from the mined area. Since alluvium is likely to be drained by mining, ephemeral streamflow may be slightly reduced as water infiltrates to the alluvium.

Channels might have to be diverted around the mine pit to carry their natural flows. The channelization could decrease annual and low flow rates because of seepage loss to the pit. Peak flows should be somewhat reduced.

Channelization of stream courses could cause increased flow velocities, and the release of production water, including mine drainage, could alter the flow characteristics of streams. Erosion and sedimentation might increase during construction and operation of the mine, after the removal of vegetation and before its reestablishment on reclaimed areas.

Spoil material would not be great enough in some areas, even with swell, to replace the total void left by coal removal. If this depression is not filled with earth materials, stream ponding and, in some cases, channel erosion could result.

Alluvial Valley Floors and Floodplains

Plant drawing from subsurface water (subirrigation) in the alluvium would be influenced to a slight degree by increased groundwater chemical concentrations following mining. The effect would be greatest in the subirrigated land adjacent to the tract. Downstream land would be less affected, because less concentrated water from outside the tract would dilute the increases in concentration from mining the tract. Crops that are more sensitive to salts (alfalfa) would be affected more than less sensitive ones (barley).

VEGETATION

If the range were in excellent condition (76%-100%) and the entire area were mined, there would be an approximate loss of 2,047 to 2,905 AUMs. However, in its present condition, the loss would be approximately 1,534 AUMs.

Mining of the area would temporarily eliminate opportunities for domestic livestock to occupy the surface and to utilize the forage. However, vegetative production may be better after mining (due to extensive reclamation work) and the area may produce more than the current number of AUMs per acre. There is, however, no evidence that the plant community that ultimately evolves would support higher levels of livestock grazing than the premining vegetation supported.

Additional impacts resulting from vegetative disturbances would be: (a) possible reduction of the visual aesthetics, (b) increased soil erosion, and (c) reduction in the amount of wildlife and livestock forage.

AGRICULTURE

If this area is mined, there would be approximately 2,927 surface acres suitable for cropland that would be lost for the term of mining and reclamation operations. This land could produce approximately 19,516 bushels of wheat (based on 50% land summer fallow, 50% wheat) or 2,407 tons of hay annually under dryland conditions. There are 1,334 surface acres suitable for irrigation that could produce an additional 57,424 bushels of wheat or 5,052 tons of hay annually. However, only 658 acres (49.33%) of the suitable cropland is currently being utilized as cropland.

OWNERSHIP AND LAND USE

If the tract were mined, the county road that crosses approximately 3.3 miles of the tract would have to be closed or relocated. A small amount of disturbance would occur if the present excess roads are improved. Approximately 364 acres would be disturbed for construction of a 30-mile rail spur line to the Burlington Northern rail system at Leiter, Wyoming. Construction of power lines or pipelines to the tract would cause low to moderate surface disturbances for the life of the mine.

WILDLIFE

Mining the tract would destroy two sage grouse leks over federal coal. Mitigation for this loss has been arranged by the Montana Department of Fish, Wildlife, and Parks (BLM 1981).

A small portion of the area-wide mule deer and antelope winter range would be destroyed if the tract were mined. This may slightly reduce the big game carrying capacity of the area.

Prairie dog towns within the tract would be destroyed. There would be a loss of habitat for those species that depend on dog towns for burrows.

Poaching and road kills have increased dramatically in areas of Montana, Wyoming and Colorado where energy development has occurred. The problem is compounded in areas where shift changes coincide with feeding periods, especially in big game (Streeter, et al 1979). The same would probably occur in this area.

If mining degrades water quality in the Hanging Woman drainage, there would be reduced spawning success of game fish in the lower reaches of Hanging Woman Creek.

CULTURAL RESOURCES

Under the proposed action, the area would be mined, resulting in the destruction of all cultural sites in the mine area, and in an adverse effect to sites immediately adjacent from haul roads, vehicle traffic and soil erosion. Prior to actual mining, the remaining unsurveyed mine area would be inventoried to Class III specifications. The exception to Criterion 7 for unsuitability would be applied and eligible sites mitigated through data recovery, pending consultation with the State Historic Preservation Officer.

RECREATION

Because of the destruction of wildlife habitat by mining, hunting opportunity in this area would be further reduced. The impact from mining would extend off-site because of the influx of mine workers, thus surrounding public lands may receive additional hunting pressure.

VISUAL RESOURCES MANAGEMENT

Visual intrusions consisting of mining equipment, overburden piles and structures (roads, shops, powerlines, buildings, etc.) necessary for a mining operation might be visible from the gravel road west of Hanging Woman Creek. The intrusions would create a contrast, new horizons and forms in this area. Also, the current terrain would give way to more of a rolling type of landscape. The mining activity would result in an increase of traffic on the rural roads, which would be an additional visual intrusion.

CLIMATE AND AIR QUALITY

Impacts on climate from the proposed action would be localized and insignificant. Reclamation would mitigate any impacts over the long term that surface modification could cause to climatic conditions.

During full coal production, the highest annual average ambient concentration of total suspended particulates (TSP) for locations off the mine site were estimated to be 30 mcg/m^3 for the North Decker tract, which is about 19 miles west. This included the 20 mcg/m^3 background concentration. The Montana standard is 75 mcg/m^3. North Decker is the closest tract to the Hanging Woman Creek tract that has been modeled for air quality impacts and is, therefore, the best estimate of what would happen.

Montana also has a 24-hour standard of 200 mcg/m^3 that cannot be exceeded more than once a year off the mine site. With the background concentration added, the second highest 24-hour values for TSP with the proposed action during full coal production would be as high as 52 mcg/m^3 for North Decker.

Visibility reductions resulting from the second highest 24-hour concentrations would be a maximum of 0.1 mile. More detailed and site specific air quality data for this tract will be forthcoming from a study underway by PEDCo Environmental. A more accurate prediction of impacts to air quality will be included in the study results.

Application of best available control technology must be a part of any mining activity. Without these controls, concentrations would be increased dramatically.

NOISE

Effects of mine related noise would generally be confined to the mine and adjacent areas and have little impact elsewhere (Colstrip project DEIS Vol 1). Noise sensitivity for the land uses that would be affected in this area, namely mining and grazing, have been rated as insensitive (Mestre and Wooten 1980).

Besides blasting, the greatest mining noise emanates from the dragline. At a distance of 300 feet, the noise level of an electric dragline is 59 dBA. A noise level of 90 dBA can be tolerated for eight hours without a risk of hearing loss (Mestre and Wooten). According to a "Trend of Public Reaction to Peak Noise Near Residences" (Mestre and Wooten), noise levels up to 67 dBA are accepted with complaints rare. Sound levels may exceed 110 decibels during blasting (East Decker Coal Mine DEIS). A noise level of 110 dBA can be tolerated for up to one-half hour per day before there is a risk of hearing loss.

Effects of mining noises on animals is often that of dispersing them into areas away from the mine site. Experience is showing, however, that animals do become accustomed to the noise and return to reclaimed areas with a mine still in operation. Western Energy Company has an established sharp-tailed grouse area on one of their reclaimed areas and they often see deer frequenting the site. Indeed, some researchers have complained of the nuisance wild animals can be in revegetation attempts (Schwarzkoph, 1982).

TRANSPORTATION FACILITIES

Approximately 3.3 miles of an improved ranch access road which lies within the tract would have to be closed or relocated if the tract were mined. The existing gravel roads that provide access to the site would require widening and resurfacing to handle increased traffic to the site. A rail spur 30 miles long would have to be constructed from Leiter, Wyoming, to serve the mine.

SOCIOECONOMICS

Economics (Agriculture)

Coal development displaces some agricultural production. To evaluate this issue, it is necessary to compare the value of the agricultural production displaced with that of the coal which could be developed. The trade-off was compared two ways.

One way was to compare the net national value of agricultural production displaced with the net national value of coal produced. In this evaluation, it was assumed the net value of coal is 12.5% (minimum royalty rate) of the assumed market rate for coal of $10 per ton. The net value of agricultural production is the cash rent to the landowner. A "worst case" situation was assumed for agriculture, that is, the area would not be reclaimed. Since agricultural production would be lost on each acre, year after year, these losses were totalled to show losses in perpetuity. By comparison, coal output per acre would be gained only once. To place agricultural production and coal on the same time basis, it was necessary to discount the value of agricultural output lost in future time periods. Regardless of inflation, a loss in agricultural production in the future is worth less than if it were lost today, because of the time value of money.

Under these assumptions, Table HW-7 shows the return to national income from coal production would be over 2,180 times greater than agricultural production.

Another way of comparing the trade-off between coal and agricultural resources is to determine what coal would have to sell for to equal agricultural production displaced. This avoids assuming all coal in the area could be sold for the going market value. Table HW-7 shows that coal would have to sell for only $.0006 per ton to be equal to the net agricultural value displaced.

TABLE HW-7
COMPARISON OF VALUE OF AGRICULTURAL PRODUCTION DISPLACED
TO VALUE OF COAL PRODUCTION

	Agricultural Production						Coal Production					
Crop	Acres	Annual Ag Production	Net Value Per Unit	1/ Total Annual Net Value $	2/ Total Present Value at 10%	3/ Per Acre Loss if Mined	Federal Acres	Recoverable Tons/Acre	4/ Net Value per ton $	5/Total Present Value 106	6/ Ratio to Ag Prod.	7/ Value per ton to equal Ag. Prod.
Hay Tame	17	15 Tons	20/Ton	$300	3000							
Past.	641	573 AUMs	10/AUM	$5,730	57,300	$23.37	9,145	40,765	$1.25	465,990	2,180	$.0006
Rang-land	8,486	1,534 AUMs	10/AUM	$15,340	153,400						to 1	
Total	9,144			$21,370	$213,700							

1. Annual agricultural production x net value per unit
2. Total present value discounted at 10%
3. Total present value/total acres
4. 12.5% x assumed value of $10.00 per ton at mine mouth
5. Acres x tons/acre x net value per ton
6. Total present value (coal)/total present value (agriculture)
7. Agricultural production per acre loss if mined/tons per acre

Concern has been expressed that extensive strip mining could have an effect on the supply of agricultural land, and thus, the national food supply.

To gain a perspective on this issue, the value of agriculture production to be potentially displaced by mining can be compared with the value of agricultural output in the consideration area.

Table HW-8 shows mining of the federal coal in the consideration area in Big Horn County could displace 0.22 percent of the county's agricultural production of hay and cattle, which had a value in 1978 of $24,119,000 (Commerce Department, 1982).

A "worst case" scenario was assumed, in the above comparison, that the area would not be reclaimed. Existing state and federal laws require the lands to be returned to the approximate original contour and be reseeded to native species. Evidence collected on current reclamation efforts suggests postmining productivity is similar to premining productivity, at least in the short-term.

Long-term results are yet to be evaluated as reclaimed lands have not been monitored over a long period of time.

Regional Economics

Due to the uncertainty of the market for coal, it is not possible to display actual tonnage figures, employment figures and time frames for this proposed mine. If this tract is sold at a future coal lease sale, community leaders of all possible impacted communities should establish communications with the lessee at the earliest opportunity. This communication would enable leaders to have access to more exact figures and time frames. The coal company must apply for a permit to mine by furnishing a proposed mining plan to the Montana Department of State Lands. Upon approval of an EIS, a permit is issued.

Possible impacts from mining coal are identified using a typical 10 million ton per year mine. Figures used are all assumed and should not be used by local community leaders for making final determinations. They should be used as a guide to show what future impacts could be.

During the construction stage of a mine, approximately two years, employment would be short range, utilizing many workers from all construction trades. It is assumed that for this mine scenario, that this figure would peak at approximately 450 workers. Case studies of other developments indicate that construction workers tend not to relocate, but rather commute long distances daily or weekly. Only about 30% of the immigrants have families averaging 3.2 persons per household. Therefore, the 450 peak number of workers would add approximately 747 people to the total population of the area.

Operating workers for this size of a mine would be 300 workers. Operational workers would be more permanent and a larger percentage (75%) would bring families into the area. Population impacts of operational workers would be 795 additional people into the area.

Secondary employment or local service employment in small communities is related to households and population. This is complicated by the fact that most local service workers do not represent new in-migration. These jobs are often filled by second job holders (wives, young people) in the base population or from among the families of in-migrating construction or operating workers. Such jobs have very beneficial economic impacts, since they add to family income without adding significantly to the population base.

For the proposed Hanging Woman mine, it is assumed that 80% of the construction and operations workers would reside in Sheridan County, Wyoming. The remaining workers would come from the present Indian reservations or Big Horn County population. Very little in-migration to Big Horn County is expected unless a new town is developed.

Table HW-9 displays the forecasted impacts to Sheridan County if the Hanging Woman mine is developed. The construction phase would cause a 2.8% increase in population. This population increase would require temporary housing such as apartments, motels, mobile homes, mobile home parking pads, and recreational vehicle pads.

The operational work force would be more permanent and would be looking for permanent housing. A 3.3% increase in population would develop.

Although these projected population impacts are small, there would be additional expenses to the county and city to provide for the additional services needed. Sheridan County, Wyoming, does not receive taxes from production of coal from mines in Montana. Consequently, additional fees and taxes may be needed to generate additional revenues.

On the other hand, Big Horn County would receive benefits, yet bear few of the social costs (excluding environmental costs) due to sparse population in the area of the proposed mine.

TABLE HW-8
COMPARISON OF COAL TRACT ANNUAL AGRICULTURAL PRODUCTION
TO COUNTY AGRICULTURAL PRODUCTION

Hay			Cattle					
Annual Prod. (Tons)	2/ Annual Sales $	Percent of County Sales	Annual Production (AUMs)	3/ Annual Sales	Percent of County Sales	4/ Gross Annual Agr. Sales by Coal Area	5/ Gross Annual Agri Sales by County	6/ % of County Agri Production Displaced
15	$825	.043	2,107	$52,675	0.24	$53,500	$24,119,000	0.22

1. Tons x $55 = value of annual sales
2. AUMs ÷ 12 AUM/Cow = cow units x 300 sales per cow unit = value of annual cattle production
3. Total of two annual sales columns
4. 1978 Census of Agriculture, Department of Commerce, US Printing Office, Washington, DC, June 81
5. Value of production displaced as a percentage of all agricultural production in the county

TABLE HW-9
FORECASTED IMPACTS
TO SHERIDAN COUNTY DUE TO HANGING WOMAN CREEK MINE

	1/Employees	No. With Families	Average Size	4/ Total Population Impact	Pct. Increase	5/ Projected Housing Unit Needs	6/ School Age Children
Construction Phase	360	2/ 108	3.2	706	2.8	308	94
Operations Phase	240	3/ 180	3.2	816	3.3	356	109

1. 80% of total employment
2. 30% with families
3. 75% with families
4. 1980 census for Sheridan County 25,048 people
5. Total population impact ÷ 2.29
6. 13.38% of total population, computed from 1980 census/1980 school enrollment

In 1982, Big Horn County's total average mill levy for state, county and school purposes was 96.95 mills. Statewide, the average mill levy was 205.27. This tax rate may decrease further as new mines are developed.

The State of Montana would also receive additional revenues from new development. Assuming a $10 million ton per year mine and a price of $10 per ton, the state would receive $30 million per year in severance tax. In addition, they would receive one half of the federal royalties. Employment of Crow and Northern Cheyenne Indians would help to eliminate a high unemployment rate. However, mine development may cause additional traffic through the reservations by commuting workers. The largest use of reservation roads is reported to come from Indian workers residing on the reservation.

NET ENERGY ANALYSIS

A net energy analysis calculated by the BLM (W.O. IM 79-282) indicates that an average of 37.7 British thermal units (BTUs) would be expended to produce each pound of coal from the Hanging Woman tract. In turn, a pound of coal would produce about 8,549 BTUs. The ratio of energy produced to that expended would be more than 226 BTUs to 1 BTU.

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HANGING WOMAN CREEK UNSUITABILITY SUMMARY

UNSUITABILITY CRITERIA RESULTS

Criterion	Applicable to Tract?	Exceptions Used	Additional Data Needed	Comments
1. Federal land systems	No			
2. Rights-of-way and easements	No			
3. Buffer zones for roads, buildings, etc.	No			
4. Wilderness study areas	No			
5. Scenic areas	No			
6. Land used for scientific study	No			
7. Historic lands and sites	No			
8. Natural areas	No			
9. Federally listed endangered species	No			
10. State listed endangered species	No			
11. Eagle nests	No			
12. Eagle roosts and concentration areas	No			
13. Falcon cliff nesting sites	No			
14. Migratory birds	No			
15. State high-interest fish and wildlife	Yes			Mitigation plan developed to allow leasing.
16. Flood Plains	No			Some surface may be affected by determination of flow threat to loss of life or property.
17. Municipal watersheds	No			
18. National Resource Waters	No			
19. Alluvial valley floors	Possibly	None	Yes	OSM and DSL will have to make determinations perior to mine plan approval.

APPENDIX

SUMMARY OF RESOURCE AND ENVIRONMENTAL CONSIDERATIONS HANGING WOMAN CREEK COAL LEASING TRACT

Element	Present Situation	Anticipated Effect of Leasing and Development	Significance of Anticipated Effect	Data Reliability	Comments
GEOLOGY & TOPOGRAPHY					
Geology					
Locatables	No claims	No impacts	Low	Excellent	
Leasables	Oil and Gas	Very minor impact; no drilling during life of mine	Low	Excellent	No producing or produced, plugged wells within area as of 10-82
Saleables	Scoria	Scoria wil be destroyed. Some use for mine roads.	Moderate	Good	Minor use of scoria as of 10-82
Paleontological		Destruction of some leaf shell fossils. Possible exposure of more fossil zones	Low	Moderate	No valuable paleo resource known to exist
Topography	High hills and deep coulees in places	Reduction of slope with more rounded postmine relief. Loss of high hills, ridges and deep coulees	Moderate	High	Less runoff, erosion, more infiltration and soil moisture

APPENDIX

SUMMARY OF RESOURCE AND ENVIRONMENTAL CONSIDERATIONS
HANGING WOMAN CREEK COAL LEASING TRACT

Element	Present Situation	Anticipated Effect of Leasing and Development	Significance of Anticipated Effect	Data Reliability	Comments
SOILS	There are 33 soil mapping units in the tract mapped at Order Two in a survey done by the Soil Conservation Service. These soil units may be found along gullies and undulating to very steep side slopes	There would be: displacement of soil by water and wind erosional forces, change in soil structure and natural fertility and significant problems in revegetation and stabilization on steep slopes	Moderate to high	Data reliability is 80% from the Big Horn County Soil Survey Better soils in the bottomlands are more accurately mapped than those on the rangelands and steep-sided slopes	

APPENDIX

SUMMARY OF RESOURCE AND ENVIRONMENTAL CONSIDERATIONS
HANGING WOMAN CREEK COAL LEASING TRACT

Element	Present Situation	Anticipated Effect of Leasing and Development	Significance of Anticipated Effect	Data Reliability	Comments
WATER RESOURCES					
Groundwater					
Occurrence	Four wells being used. 27 cased test wells. Static water levels are 6 to 217 feet	Destruction of existing wells		There may be more wells on tracts	Supplies could be replaced by deeper wells at considerable expense
Quantity	10 gallons per minute				
Conductance	742-10,500 micromhos per centimeter	Higher in reclaimed spoils aquifer		Good	
Dissolved solids	438 - 9,460 milligrams per liter	Higher in reclaimed spoils aquifer		Good	
pH	7.0 - 8.8	Lower in spoils aquifer		Good	
Importance for homes or towns	Probably some domestic use	Loss of present supply	Moderate		

APPENDIX

SUMMARY OF RESOURCE AND ENVIRONMENTAL CONSIDERATIONS
HANGING WOMAN CREEK COAL LEASING TRACT

Element	Present Situation	Anticipated Effect of Leasing and Development	Significance of Anticipated Effect	Data Reliability	Comments
Importance for industry	Nil				
Importance for livestock and wildlife	Primary use	Loss of present supply	Moderate		
Importance for agriculture	Nil				
Surface Water					
Occurrence	Small portion of a perennial stream. Five stock ponds	Protection of stream and removal of reservoirs during mining	Moderate		
Quantity	Hanging Woman, 3,740 acre feet per year (average); largest reservoir covers 3 surface acres				

APPENDIX

SUMMARY OF RESOURCE AND ENVIRONMENTAL CONSIDERATIONS
HANGING WOMAN CREEK COAL LEASING TRACT

Element	Present Situation	Anticipated Effect of Leasing and Development	Significance of Anticipated Effect	Data Reliability	Comments
Conductance	3,764 micromhos per centimeter (E. Trail Cr.)	Possible increase during mining	Minimal	Good	
Dissolved solids	3,500 milligrams per liter (E. Trail Cr.) and 2,031 mg/l (Hanging Woman)	Possible increase during mining	Minimal	Good	
pH	8.2 average for E. Trail Creek	Possible decrease during mining	Minimal	Good	
Importance for homes or towns	Nil				
Importance for industry	Nil				
Importance for livestock and wildlife	Primary use	Loss of some supplies during mining	Moderate		
Importance for agriculture	Some flood irrigation from Hanging Woman Cr.	Unless protected, could be decreased during mining	Moderate		

APPENDIX

SUMMARY OF RESOURCE AND ENVIRONMENTAL CONSIDERATIONS
HANGING WOMAN CREEK COAL LEASING TRACT

Element	Present Situation	Anticipated Effect of Leasing and Development	Significance of Anticipated Effect	Data Reliability	Comments
VEGETATION	Range Sites: (Acres) Silty 1907 Shallow Silty 1252 Clayey 1945 Sh. Clay Si 1840 Other 1542 TOTAL 8,486	Acres being disturbed Silty 1907 ac. Hi Shallow Silty 1252 ac. Hi Clayey 1945 a . Hi Sh. Clay, Si 1804 ac. Hi Other 1542 ac. lo 8,486 acres	High - - - - Long term elimination of the natural vegetation mosaic and species diversity	Good	Reclamation of Ponderosa pine not yet proven
Animal Unit Mos.	1534 AUMs	High	Loss of 1534 AUMs High	Good	
Animal Unit Months if range is in excellent condition 76-100%				Good	76% 100% 2047 2905 AUMs AUMs
Threatened Endangered or Noxious Species	There are no threatened or endangered plant species found growing in the EMU. However, there are six noxious species found growing in the Powder River Resource Area, but it has not been determined if these species are found growing in the EMU. The species are:	Low	Low	Good May 16, 1980 Regional Directo Region 6 US FWS Denver, Colorado	

APPENDIX

SUMMARY OF RESOURCE AND ENVIRONMENTAL CONSIDERATIONS
HANGING WOMAN CREEK COAL LEASING TRACT

Element	Present Situation	Anticipated Effect of Leasing and Development	Significance of Anticipated Effect	Data Reliability	Comments
	A.Convolulus aruensis B.Cirsium arvense C.Euphorbia esula D.Centaurea ropens E.Cardaria draba F.Centaurea maculosa				
Reclamation Vegetation	On federal, state and private lands, the Office of Surface Mining (OSM) assures that the mining company establish a diverse, effective and permanent vegetative cover to standards set by the Department of State Lands of Montana and the federal Bureau of Land Management	Low	High-failure of reclamation Low-success of reclamation	Good	
AGRICULTURE	2,927 acres suitable for cropland; 658 acres currently being cropped (17 acres, hay; 641 acres tame pasture)	Maximum of 658 acres current cropland removed from production for term of mining and reclamation operations	Low	Fair	
LAND USE	No industrial activity. Ranching is primary use.	Introduction of industrial activities. Use of land for mines, railroads, access roads, and powerlines	Moderate to high during mining. Low to none after reclamation	Good	

APPENDIX

SUMMARY OF RESOURCE AND ENVIRONMENTAL CONSIDERATIONS
HANGING WOMAN CREEK COAL LEASING TRACT

Element	Present Situation	Anticipated Effect of Leasing and Development	Significance of Anticipated Effect	Data Reliability	Comments
WILDLIFE					
Mule Deer and Antelope	Winter use northwest part of tract	Loss of this portion of winter range	Low-majority of winter range undisturbed	Good	
Raptors	No nests on the tract	Some disturbance of hunting areas	Low	Good	
Sage Grouse	Two leks on the tract	Two leks destroyed; mitigation necessary	Low - with mitigation	Good	
Fish	Water in lower Hanging Woman Creek used for spawning	Game and forage fish in Tongue River could be reduced	Low - moderate	Good	
Endangered Species	No known occurrence	None	None	Good	
Prairie Dogs	A number of prairie dog towns occur on the tract	Prairie dog towns destroyed; habitat for associated species destroyed	Low	Good	

APPENDIX

SUMMARY OF RESOURCE AND ENVIRONMENTAL CONSIDERATIONS
HANGING WOMAN CREEK COAL LEASING TRACT

Element	Present Situation	Anticipated Effect of Leasing and Development	Significance of Anticipated Effect	Data Reliability	Comments
CULTURAL RESOURCES	2,140 acres (22.85%) of area inventoried. 8 sites located	Disturbance and destruction of all sites within mine area, indirect effects to sites adjacent	Loss of resource, loss of heritage values	Date for surveyed tracts is good. Information recovered was not sufficient to make National Register determination for 7 of 8 sites	Prior to mining the mine plan area would be intensively surveyed and National Register sites would be mitigated through data recovery
RECREATION	Hunting is probably the only form of recreation on the tract. There are no natural or wilderness values.	Destruction of wildlife habitat; thus affecting hunting. Most of the impacts would be off-site	Low	Acceptable	
VISUAL RESOURCES	Area is rated as Class IV	Classification would change to V during life of mine	High effects during life of mine, but the long term effects would be low because reclamation would have to restore tract to Class IV	Fair	

APPENDIX

SUMMARY OF RESOURCE AND ENVIRONMENTAL CONSIDERATIONS
HANGING WOMAN CREEK COAL LEASING TRACT

Element	Present Situation	Anticipated Effect of Leasing and Development	Significance of Anticipated Effect	Data Reliability	Comments
AIR QUALITY	Concentration of particulates estimated at 20 mcg/m^3 (Mt standard is 75 mcg/m^3)	Highest ambient concentration of particulates would be 30 mcg/m^3	Minor	Fair	
NOISE	Sources are wind, agricultural activity, and vehicular traffic. Estimated noise level is 40 dB	Substantial increase in noise due to blasting, equipment, and more vehicle and railroad traffic. Zones of increase to 50dB for 1/3 mile around tract, 1,000 feet from railroad centerline, and for 100 to 200 feet from access road centerline	Insignificant	Acceptable	There are no land uses in affected zones that are sensitive to high noise levels
TRANSPORTATION	Existing access via graveled county roads. Low use and maintenance.	Increased traffic on gravel access roads and on state highway 314 and U.S. Route 212	Low to moderate during mining. Low when mines close	Good	
	Improved ranch access road lies across tract	Construction of new roads. Improvements on existing roads. Construction of railroad. Loss of ranch access road	Moderate to high		

SUMMARY OF RESOURCE AND ENVIRONMENTAL CONSIDERATIONS
HANGING WOMAN CREEK COAL LEASING TRACT

Affected Community	Affected Element	1978 ($1000)	Anticipated Effect of Action $1,000	Assumptions	Significance of Effect
AGRICULTURAL ECONOMICS					
Big Horn County	Annual Agricultural Receipts	$53,500	-$875	Assumes all 17 acres of Hay disturbed. Less than 1% of county agricultural production	Low
			-$52,675	Assumes all 2,107 AUMs are lost for life of mine. Less than 1% of county agricultural production.	Low

EMPLOYMENT AND POPULATION

Element	Affected Community	Affect of Action	Significance of Effect	Data Reliability
Employment:	Big Horn County	90 more jobs	Low: 17% increase in county employment	good
Construction of Mine	Sheridan County, WY	360 more jobs	Low: 4.6% increase in county employment	good
	Big Horn County	60 more jobs	Low: 1.1% increase in county employment	good
Operation of Mine	Sheridan County, WY	240 more jobs	Low: 3% increase in county employment	good
Population:	Big Horn County	238 more people	Low: 2.1% increase	good
Construction of mine, Operation of mine	Sheridan County, WY	706 more people	Low: 2.8% increase	good
	Big Horn County	159 more people	Low: 1.4% increase	good
	Sheridan County, WY	816 more people	Low: 3.3% increase	good

UNITED STATES DEPARTMENT OF THE INTERIOR
MINERALS MANAGEMENT SERVICE

PART II

1984 Lease Sale — Coal

Summary Report — Hanging Woman Creek Tract
Northern Powder River Basin
Big Horn County, Montana

North Central Region
Billings, Montana

November 30, 1982

TRACT SUMMARY REPORT

Minerals Management Service, North Central Region
Billings District
Billings, Montana

Revision
Date: November 30, 1982

TRACT DESCRIPTION

Tract Name: Hanging Woman Creek No.:

Coal Region: Powder River

State: Montana County: Big Horn

BLM Resource Area and Planning Unit: Powder River RA; Hanging Woman Planning Unit

USGS Quadrangle Maps: Forks Ranch, Quietus

Legal Description: See Attachment A and Attachment B (Tract Location Map)

Known Recoverable Coal Resource Area (KRCRA): Northern Powder River

Tract Acres (by BLM)

Federal Uncommitted:	9144
Federal Committed:	0
State:	720
Private (Fee):	0
Total Tract:	9864

Approximate Acres Underlain by Coal:

Federal Uncommitted:	9055
Federal Committed:	0
State:	720
Private(Fee):	0
Total Tract:	9775

Estimated In-Place Coal Tonnage:

Federal Uncommitted:	598.8 MMT
Federal Committed:	0 MMT
State:	51.2 MMT
Private (Fee):	0 MMT
Total Tract:	650.0 MMT

*Estimated Recoverable Coal Tonnage:

Federal Uncommitted:	372.8 MMT
Federal Committed:	0 MMT
State:	27.2 MMT
Private (Fee):	0 MMT
Total Tract:	400.0 MMT

* Deductions from the in-place tonnage were made for buffer, highwall reduction, and associated disturbance zones. Then a recovery factor of 90% was applied to the remaining tonnage to obtain the recoverable tonnage.

ENTITIES EXPRESSING INTEREST

Cyprus Coal Company
Kendrick Cattle Company

COAL RESOURCE CLASS DESIGNATION

CLASS 1: Good

Confidence in resource estimates is good because the surface areas of category "A" and "B" resources cover two-thirds or more of the total surface area of the tract

CLASS 2: Moderate

Confidence in resource estimates is moderate because the surface areas of category "A" and "B" resources cover one-third to two-thirds of the total surface area of the tract.

CLASS 3: Poor

Confidence in resource estimates is poor because the surface areas of category "A" and "B" resources cover one-third or less of the total surface area of the tract.

POTENTIAL FOR DEVELOPMENT OF TOTAL TRACT
Hanging Woman Creek Tract

EVALUATION FACTORS	CLASS 1	CLASS 2	CLASS 3
Coal Resources	X		
Coal Quality		X	
Transportation			X
Minability		X	
Marketability		X	
Overall Class		X	

(See Attachment C for basis of class determination.)

COAL RESOURCE CATEGORY DEFINITIONS

CATEGORY "A" RESOURCES

Resource quantity is estimated from data sources that are adequately spaced to assume, with a high degree of confidence, continuity between data points. The geologic character of the area is well defined. The resources for the Hanging Woman Creek tract also meet the demonstrated reserves category of USGS Bulletin 1450-B.

CATEGORY "B" RESOURCES

Resource quantity is based on an assumption of continuity between data points with a lower confidence level than that of category "A" resources. The geologic character of the area is not as well defined as category "A" resources.

CATEGORY "C" RESOURCES

Resource quantity is based on an assumption of what can reasonably be expected to exist in the same producing region under analogous geologic conditions with a lower confidence level than that of either category "A" or "B".

POTENTIAL FOR DEVELOPMENT OF TOTAL TRACT
TOTAL IN-PLACE TONNAGE OF HANGING WOMAN CREEK TRACT

Coal Bed	Average Thickness	Resources (million short tons)		
		Category A	Category B	Category C
Anderson	29	490.5	---	---
Dietz	9	159.5	---	---

Coal Rank: Subbituminous
Unit Weight: 1770 tons per acre-foot

IN-PLACE TONNAGE - FEDERAL UNCOMMITTED

TRACT: Hanging Woman Creek

Coal Bed	Average Thickness	Resources (million short tons)		
		Category A	Category B	Category C
Anderson	29	452.8	---	---
Dietz	9	146.0	---	---

Coal Rank: Subbituminous
Unit Weight: 1770 tons per acre-foot

IN-PLACE TONNAGE - STATE

TRACT: Hanging Woman Creek

Coal Bed	Average Thickness	Resources (million short tons) Category A	Category B	Category C
Anderson	31	37.7	---	---
Dietz	11	13.5	---	---

Coal Rank: Subbituminous
Unit Weight: 1770 tons per acre-foot

OVERBURDEN/INTERBURDEN THICKNESS RANGES

Anderson	overburden	- Min. 0 feet	Max. 420 feet
Dietz	overburden	- Min. 100 feet	Max. 200 feet
Anderson-Dietz	interburden	- Min. 40 feet	Max. 116 feet

COAL GEOLOGY OF THE HANGING WOMAN CREEK TRACT

The two minable coal seams in the Hanging Woman Creek tract are in the Tongue River Member of the Paleocene Fort Union Formation. These coals are the result of a massive accumulation of organic material in a back-swamp adjacent to a northward-flowing river system (Flores, 1982), analogous to the modern day Mississippi River.

The minable beds in descending order are the Anderson and Dietz. The Anderson is burned to a certain extent on the west side of the tract where the coal outcrops along the Hanging Woman Creek valley.

One northeast-southwest trending fault cuts the tract with displacements up to 230 feet. Otherwise, the structural geology of the tract is uncomplicated, with beds dipping less than 1° to the southwest.

There are no producing oil and gas wells in the area although several "dry" holes have been drilled. Several oil and gas leases exist in the area. Geologic hazards are not anticipated anywhere within the tract.

COAL QUALITY - HANGING WOMAN CREEK TRACT (as received)

(Values in percent, except BTU)

Coal Bed	Number of Samples	Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	BTU/lb
Anderson	5	27.43	29.50	37.83	5.28	0.45	8,549
Dietz	1	28.6	29.0	35.5	6.9	.60	8,300

Source: Matson and Blumer, 1973; Culbertson, et al, 1978)

(Coal quality for the Federal uncommitted and State coal is estimated to be the same as above)

POTENTIAL USE OF COAL: 1. Export to Midwest or South for electrical generation.
2. Export to foreign markets.
3. On-site electrical.
4. On-site syn-fuel conversion.

TRANSPORTATION:

	Mode	Distance to Transportation Link
Existing		
Being Developed		
Being Planned	Railroad	30 miles
None Planned		

MINABILITY:

Type of Mine: Conventional surface strip mine utilizing dragline and truck-shovel methods.

Estimated Recovery:

Based on current practices in the Powder River Basin coal region, a recovery factor of 90 percent is typical. However, this percent recovery may or may not be attained.

Estimated Annual Production:

Federal Uncommitted: 9.3 million tons

Total Tract: 10.0 million tons

Estimated Mine Life: 40 years

Estimated Surface Acres to be Mined Per Year:

Federal Uncommitted: 226 acres

Total Tract: 244 acres

Active, Inactive, and Abandoned Mines or Leases in Tract Vicinity:

No mines or leases have been identified within the tract boundary. The nearest active mines are 15 miles to the west near the Tongue River resevoir. The Mud Springs tract is approximately 6 miles to the northeast.

MARKETABILITY

The quality of coal in this tract is in the mid-range of coals presently being being mined in the Powder River Basin. Coal from this tract should compete favorably in all markets. The great expense of installing rail haulage facilities to the tract could be moderated by the large resource base and possibly by sharing construction costs with an operator of the Mud Springs tract.

REFERENCES: See Attachment D

TRACT LEGAL DESCRIPTION

HANGING WOMAN CREEK

Principal Meridian, Montana

FEDERAL UNCOMMITTED	Acres
T. 8 S., R. 44 E.,	
sec. 31, lots 6, 12, 13, and lots 15 to 20, inclusive;	298.79
sec. 32, SE1/4SE1/4;	40
sec. 33, S1/2SW1/4.	80
T. 9 S., R. 43 E.,	
sec. 1, lots 1 to 4, inclusive, S1/2N1/2, and S1/2;	645.08
sec. 2, lots 1 to 4, inclusive, S1/2N1/2, and S1/2;	643.20
sec. 3, lots 1 and 2 and S1/2NE1/4;	161.40
sec. 10, S1/2NE1/4, E1/2SE1/4NW1/4, SW1/4SE1/4NW1/4, E1/2SW1/4, and SE1/4;	350
sec. 11, NE1/4, E1/2NW1/4, and S1/2;	560
sec. 12, All;	640
sec. 13, All;	640
sec. 14, N1/2, SW1/4, N1/2SE1/4, and SE1/4SE1/4;	600
sec. 15, NE1/4, NE1/4NW1/4, N1/2SE1/4, and SE1/4SE1/4;	320
sec. 23, E1/2NE1/4 and NE1/4SE1/4;	120
sec. 24, N1/2NE1/4, SE1/4NE1/4, W1/2, and E1/2SE1/4.	520
T. 9 S., R. 44 E.,	
sec. 4, NW1/4NW1/4;	40
sec. 5, E1/2, E1/2SW1/4, and SW1/4SW1/4;	440
sec. 6, lots 1 to 20, inclusive, SW1/4NE1/4, and SE1/4;	919.68
sec. 7, lots 1 to 19, inclusive, NE1/4, and N1/2SE1/4;	921.12
sec. 8, W1/2NE1/4, SE1/4NE1/4, NW1/4, and NE1/4SE1/4;	320
sec. 18, lots 4 to 7, inclusive, lot 9, and lots 11 to 20, inclusive;	522.52
sec. 19, lots 1 to 10, inclusive, and NW1/4NE1/4.	401.78
Total	9,183.66
Rounded Total	9,184

STATE COMMITTED	
T. 8 S., R. 43 E.,	
sec. 34, S1/2SE1/4;	80
sec. 35, S1/2;	320
sec. 36, S1/2.	320
Total	720
Tract Total	9,903.66
Rounded Tract Total	9,904

Attachment B

TRACT MAP
-Hanging Woman-

Please see the tract map at the beginning of Part I.

DETERMINATION OF TRACT CLASS
- Hanging Woman Tract -

Coal Resources

Confidence in resource estimates is good and Category "A" resources underlie more than two-thirds of the tract total surface area; therefore, a Class 1 or good potential rating was assigned.

Coal Quality

Weighted averages of the proximate analyses of the Anderson and Dietz coal seams placed the tract in the mid-range of coals presently being mined in the Powder River basin. Accordingly, a Class 2 or moderate potential rating was assigned.

Transportation

Approximately 30 miles of railroad would have to be constructed to provide rail access between the tract and the Burlington Northern rail system at Leiter, Wyoming. Topographic features make this the most logical corridor. A Class 3 was assigned based on the following criteria:

Rating	Distance to Established Transportation Link
Good	0-7 miles
Moderate	7-15 miles
Poor	15+ miles

Minability

Conservation dictates that the Anderson and Dietz seams be mined simultaneously to a maximum 6:1 stripping ratio or to 200 feet of overburden. These maximum stripping limits are comparable to similar mines operating in Montana. The maximum stripping limits for both seams are prevalently reached inside the boundaries of the tract. The combined effects of the complexity of mining two seams and going to maximum stripping limits have resulted in the assignment of a Class II moderate potential rating.

Market and Overall Potential

The absence of a nearby transportation link becomes the controlling factor in rating this tract. Therefore, the market potential and overall potential in consideration of the transportation problem, are rated Class II.

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